

Sandia Climate Security Strategy



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WHY

Climate change poses a threat to national and global security

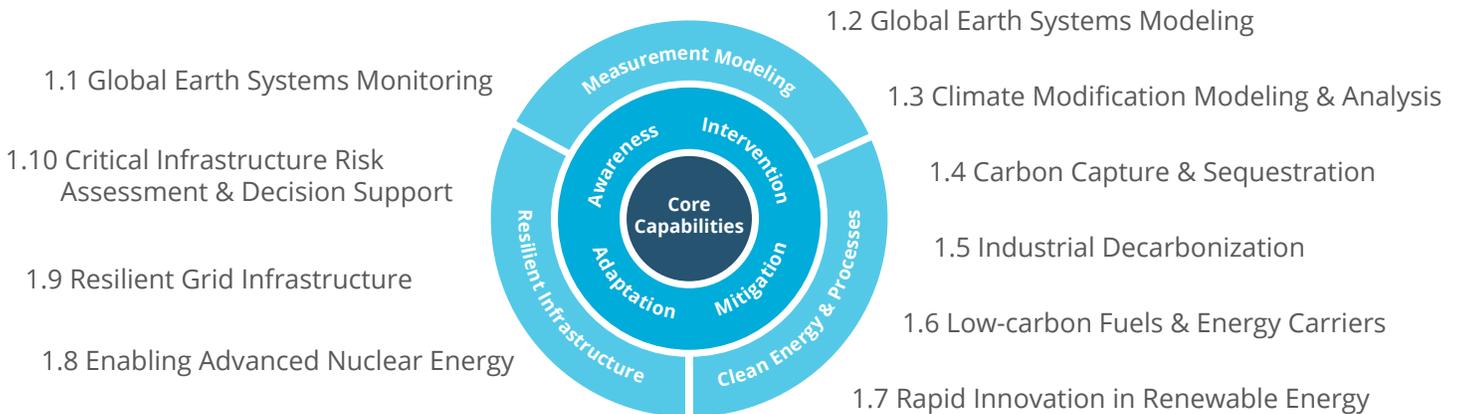
The U.S. is mobilizing a whole-of-nation approach to tackle the climate crisis

Core capabilities enabled by our foundational research and engineering excellence differentiate Sandia's efforts



WHAT

Objective 1. Advance the state of the art in key capabilities



Sandia's Mission Areas

Objective 2. Apply climate capabilities across Sandia's mission portfolios

- 2.1 Improving Climate Risk Assessment & Decision Support
- 2.2 Understanding Climate Intervention
- 2.3 Enhancing Arctic Science & Security
- 2.4 Advancing Mitigation & Adaptation
- 2.5 Enabling Treaty Monitoring & Verification

Objective 3. Build cutting-edge R&D facilities

- 3.1 Gen3 Concentrating Solar Power R&D pilot plant
- 3.2 Geosciences Research Building
- 3.3 Climate Security Analysis Center



Objective 4. Model the way forward in site sustainability and resilience

- 4.1 Net Zero Plan for NM site
- 4.2 Net Zero Plan for CA site
- 4.3 Building Sustainability Pilot



HOW

Scale up ideation & innovation through internal investment

Engage strategically with government

Partner with emphasis on energy equity & environmental justice

Increase scale and pace of technology transfer

Enhance Sandia's visibility in the climate domain

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Objective 1. Advance the state of the art in key capabilities

1.1 Global Earth Systems Monitoring

Sandia seeks to enable a persistent, operational, and high-resolution system to monitor greenhouse gas emissions globally, with an initial focus on Arctic methane. Technical areas of contribution include systems architecture and integration, synthesis of satellite-based measurements, and developing complementary ground-based measurement capabilities. Additionally, Sandia can develop monitoring systems that have broader utility, for example, advancing our situational awareness in the Arctic.

1.2 Global Earth Systems Modeling

Our scientists work with other DOE labs and university partners to develop and improve regional and Earth System models. These efforts build on our expertise in modeling, high performance computing, and climate measurements to improve our understanding of complex natural processes. Our goal is to develop a first-ever model-coupling ecosystem that can predict carbon cycle and climate feedback loops.

1.3 Climate Modification Modeling & Analysis

Drawing on our modeling expertise, Sandia is developing foundational algorithms and tools for intervention modeling, attribution, and risk analysis. These modeling advancements will not only improve Earth System model accuracy but could guide security-driven responses and inform climate modification treaties.

1.4 Carbon Capture & Sequestration

Sandia develops and demonstrates as well as identifies and models the impacts, risks, and benefits of carbon capture, utilization, and storage approaches. Sandia's broad research foundations allow for a unique approach to this work that combines geosciences, material science, and biosciences systems knowledge.

1.5 Industrial Decarbonization

We apply our extensive capabilities in solar thermal energy, materials science, and systems engineering to decarbonize industrial processes. Sandia is drawing on those capabilities to research, develop, and demonstrate carbon-free feedstocks and heat sources, energy efficient formulations, and carbon-sinking methods that can significantly reduce lifecycle carbon emissions in the production of cement and chemicals.

1.6 Low-carbon Fuels & Energy Carriers

Sandia is working to produce, deliver, store, and use hydrogen at a national scale through technologies like solar thermochemical hydrogen production and geologic storage. This research builds on our scientific foundations in materials compatibility, safety basis, and risk assessment. Sandia is also developing biofuel components for sustainable aviation fuel and developing technologies to reduce climate-forcing aviation emissions.

1.7 Rapid Innovation in Renewable Energy

Building on a robust set of capabilities in renewable energy technologies, Sandia is accelerating the development and commercialization of particle-based concentrating solar thermal systems with long-duration energy storage and advanced power cycles, and its application to high-temperature industrial processes. Our teams are also developing vertical-axis wind turbine technologies for offshore applications and advancing manufacturing of perovskite PV module technologies.

1.8 Enabling Advanced Nuclear Energy

The goals of Sandia's Advanced Reactor Ecosystem Center of Excellence are to develop safety analysis and risk assessment methods, enable accident and consequence management strategies, ensure cyber and physical security, inform siting, develop disposal strategies, enable safe transportation, and address proliferation concerns associated with next generation nuclear energy.

1.9 Resilient Grid Infrastructure

Sandia is partnering with Kirtland Air Force Base and PNM to demonstrate at-scale a fully integrated solid-state power station. We are also focused on demonstrating Sandia technology in a flexible fractal grid architecture, including optimization, controls, advanced protection, energy storage, models, and applications of AI/machine learning.

1.10 Critical Infrastructure Risk Assessment & Decision Support

Drawing on Sandia's heritage in resilience, risk, and cross-sector modeling and analysis, we are building a new Infrastructure/Climate Risk and Decision Support (ICARUS) capability. ICARUS will integrate high-fidelity infrastructure models and build cross-sector risk frameworks for climate change. This work will enable data-based, risk-informed, holistic planning and investment in infrastructure adaptation.

